MONTHLY JOURNAL OF
THE MUSHROOM GROWERS'
ASSOCIATION

MGA BULLETIN

MARCH 1961 · NUMBER 135

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5/-

AGM & ANNUAL LUNCHEON—22 MARCH

STABLE MANURE

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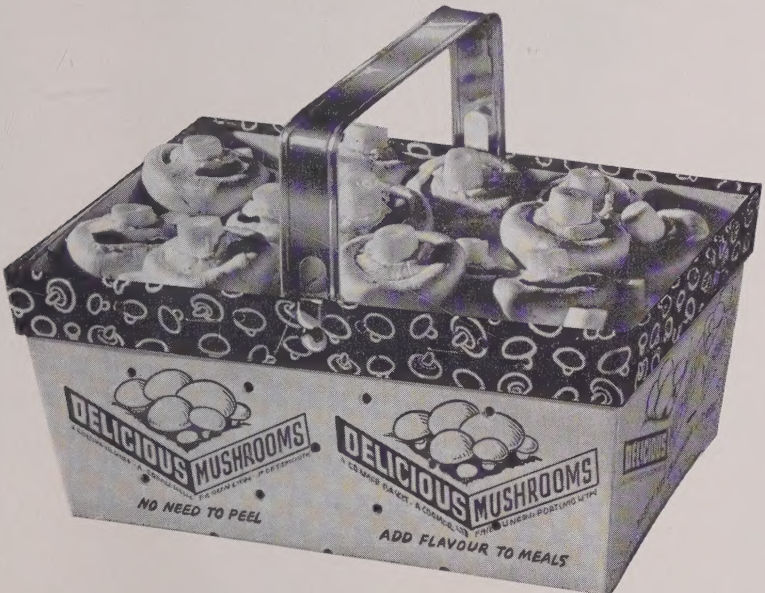

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The
MGA BULLETIN

MAR. - 1961
NUMBER 135

EDITORIAL

YOUR FORUM

Each year the Annual General Meeting of the Mushroom Growers' Association provides a splendid forum where members, large and small, may air their views and may, by so doing, give guidance to the Executive Committee in the sometimes formidable task of steering the industry through rather dangerous waters.

If the industry was controlled from top to bottom the task of keeping things neat, tidy and profitable from the growers' point of view might be comparatively easy but no such rigid control exists and there are no doubt many who think this is a good thing. The task of the Executive is therefore confined, in matters outside publicity contributions, to voluntary measures aimed at making the industry as a whole efficient and co-operative. But the Executive needs guidance from time to time and it is in the matter of guidance that the ordinary member, whatever the size of his farm, has an inescapable role to fill.

Do you think that the MGA is efficiently run? Does the Executive devote enough time to the problems of the small grower? Is co-operation extensive enough and is it being developed on the right lines? Isn't it time the Association had its own research unit devoted to problems of a practical nature? Is Publicity being carried out to the best possible advantage now that the fund has been placed on a more sound footing? Why don't more people write for the Bulletin? Is there any method, outside controlled marketing and controlled production, whereby some measure of price control can be achieved? What about that Co-operative the MGA once decided to form?

These are just a few of the questions which, no doubt, pass through the minds of members from time to time and, on which, questions could and should be asked and answered. The greatest enemy of any organisation, be it Government or an association like the MGA, is apathy, for apathy leads to inertia and inertia to stagnation. We want none of this in the MGA.

Constructive criticism and constructive ideas are wanted and the Park Lane Hotel on 22nd March is the time and the place to give such matters an airing.

WRA

CALYPSO . . .

EMPLOYEE'S APPRECIATION

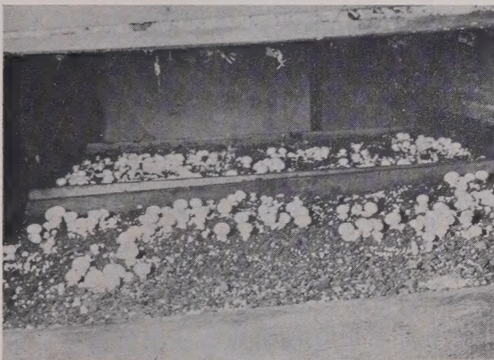
Oh lucky me, so dry and warm,
A-working on a mushroom farm:
My mates and I have much enjoyed
The life out here where we're employed,
At work so unlike mill, or mine,
Or chores attached to swill or swine;
And how it pleases us to watch
Employers building up from scratch,
(In spite of trade-winds blustery)
A live, expanding industry.
On days when it can rain for hours
We thank and praise our lucky stars
That we have sheltered, indoor work,
Devoid of smells attached to pork:
That on the coldest days on earth
Our atmosphere's like cosy hearth:
That when the sun is splitting trees
Our shade enjoys a fan-fed breeze;
And last, but then, by no means least,
When work on other farms has ceased,
Our tilth is never sodden ground
And so we work the whole year round.
To crown it all we get a kick
From holding down a job so slick,
That we could work in dinner-suits—
Envy of those in rubber boots.
No job like this, so dry and warm,
A-working on a mushroom farm.

FP (BELFAST).

"Just 'cos the Guvnor's got this load of Racing Stable Manure, I don't see that he needs to wear the owner's colours, or expect us to use—Pitchforks."

MUSHROOM GROWING ON SHEEP MANURE

Argentinian Experiments



Among agriculturists in general, sheep manure has long been known to hold advantages, generally speaking, over other types of organic manure but little is known of its use in connection with mushroom growing, probably because the material is rarely available.

Sheep are not usually kept in yards or buildings like so many other animals, except for a few short weeks during the lambing season and even this temporary housing is quite often not undertaken.

At Buenos Aires in South America, Mr. A. E. Kelsey runs a mushroom growing farm for Dr. Enrique Pueyrredon who, some months ago, was a welcome visitor to the MGA office in London.

Mr. Kelsey kindly supplied the comprehensive notes which follow.

The Site Arrangements: Cultivation is carried out on a 3,700 hectar (about 9,250 acres) ranch devoted to raising Corriedale sheep, and situated about 60 kilometers from the bathing resort of Mar del Plata. Actual mushroom production takes place in three growing sheds, each measuring 16 × 6 meters (about 50 ft. × 20 ft.), giving a bed area of 750 square meters (approx. 7,500 sq. ft.). The plant includes a pasteurization room, a small canning plant and a laboratory. All growing is on the tray system.

Obtaining and Using Compost: Sheep manure is obtained from a shed used by pedigree animals. The floor arrangements are designed to obtain compost materials with the minimum amount of trouble. The arrangements include a slatted floor raised about five feet above ground level. These slats are covered daily with wheat straw and it is on this slatted floor that the sheep are accommodated. The slats allow the straw, impregnated by urine and manure, to drop through to the floor below. Each week this manure is cleared and stacked in the open air in large piles. Such stacks are always used within a month.

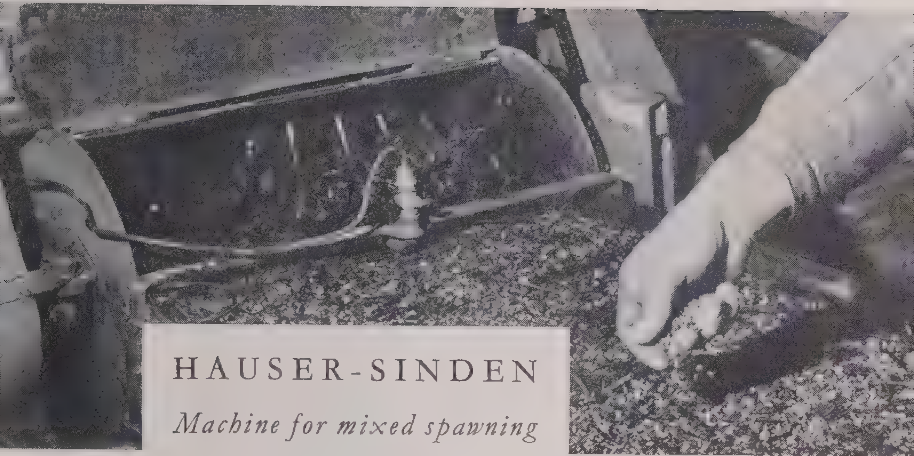
Composting and Spawning: Compost heaps are built to measure between 5 ft. and 6 ft. high and similar width. The heap is turned at intervals of five to seven days for five turns in all, trays being filled at the last turn. The trays are then placed in the pasteurisation shed and, after 24 hours, live steam pushes the compost temperature to between 130° F. and 135° F. and the temperature is held there for 24 hours or

longer if necessary. When the compost temperature drops to anywhere between 70° F. and 75° F. spawning is carried out. In short, and as Mr. Kelsey points out, the usual tray system of growing is carried out, with a few minor variations.

Observations on Sheep Manure: Despite adding gypsum in double the quantities advocated, a constant tendency towards compactness has been observed in the compost. Though the compost has a dark appearance and an almost greasy texture, the mycelium normally grows in 21 days. Adds Mr. Kelsey: " I believe we have studied this matter insufficiently. It is probable that a more critical proportion of water might be called for in the first stages. On the other hand we have observed, in the same shed, that parts of the wheat straw in actual contact with the urine and droppings has become very much compressed at stacking and prior to the first turn, and has an equally dark appearance and is difficult to pull apart by hand ". It is believed that this tendency is characteristic of sheep manure which, with further experience, may be overcome.

Casing and Output: Subsoil, sterilized with formalin, is used for casing. It is usual to case 21 days after spawning with the first pinheads appearing 21 to 28 days later. It is " noteworthy and perhaps exceptional that the whole surface of the trays are covered with pinheads, in some cases growing so thickly that it is difficult to see the casing material ". Mr. Kelsey says : " The mushrooms open to a rather small size ($1\frac{1}{2}''$ cap diameter) and there is a heavy percentage of dead pinheads. In spite of this the normal pick in seven days is four kilos per sq. meter (nearly 1 lb. per sq. ft.). Cropping then falls sharply away, the trays and the house are emptied and a fresh start made with a new batch of compost ".

Conclusions: Mr. Kelsey concludes, "As you will see, the results are acceptable enough for experimental work but we repeat that we believe it necessary to work out a technique specially adapted to this type of manure. It is possible that we have a disequilibrium in mineral salts, concurring with Pizer. We are trying tests to avoid the enormous number of dead pinheads. We think that there are also problems of nutrition and of the relationship between the cultivated surface and the ambient air or atmosphere. Later we will send more detailed and precise data but, in principle, we can state that the cultivation of mushrooms with a sheep manure compost is certainly a practical proposition, provided, of course, that such material is readily available ".



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70-2 MUSHROOM

by **Wayne A. Robbins and William S. Taylor**
Campbell Soup Company, West Chicago, Illinois

During the past fourteen years, periodic evaluations have been made of the yielding capacity and general acceptability of mushroom strains available from spawn producers and research agencies. The first published results from these studies were contained in an article by Reeve and Robbins (1). They indicated that mushroom strains differ in yielding ability. As a result of this information, a programme was initiated to develop strains superior to those available. The 70—2 mushroom, pictured above, was evolved through the efforts of these studies.

This new mushroom strain is the result of selections from Sobexas Cream 84, received from M. Guy R. de Man of Brussels, Belgium, in 1954. A tissue culture from a selected mushroom of the crop grown from the Sobexas Cream 84 was maintained on potato-dextrose-yeast agar and designated as accession 70. Subsequently, six different tissue and cultural selections of accession 70 were obtained. These selections, 70—1, 70—A, 70—B, etc., were increased on PDY agar and rye grain. The six selections produced yields ranging from .58 to 1.78 pounds per square foot in observation trials during the spring of 1955. 70—1 was the highest yielding selection. In the course of maintaining the culture of accession 70—1 on PDY agar, a particular agar slant exhibited faster mycelial growth compared with the other slants of 70—1 and those of the original accession 70. This faster growing selection was labelled accession 70—2. Other growth characteristics of 70—2 on agar were similar to those observed for 70—1. The initial indication of the superiority of 70—2 compared with 70—1 was noted in a yield trial during early 1956. Accession 70—2 produced 1.81 pounds per square foot compared with 1.32 pounds per square foot for 70—1.

Subsequent replicated yield trials from 1956 through 1960 pointed up the superior yielding ability of 70—2. The yield and size results from a representative trial are summarized in Table 1. The commercial spawns are coded in order that the makers of spawn used in the study may remain anonymous. These tests, under the conditions at our West Chicago, Illinois, mushroom farm, also showed 70—2 to produce a significantly larger mushroom when compared with the highest yielding white strain. The small scale replicated trials were augmented by half-house commercial testing during the 1957-58 growing season. The half-house (3,500 sq. ft.) yield of locally prepared 70—2 grain spawn was compared with the yield of commercially prepared spawn of white strains in the other half of the same mushroom house. The twelve half-house commercial trials during the 1957-58 season resulted in a slight yield advantage and a considerable size advantage for 70—2 compared with white strains. Accession 70—2 produced an average of 30 fewer mushrooms per pound compared with the white strains. In twelve half-house commercial trials at West Chicago during the 1958-59 season, 70—2 produced an average yield of 1.88 pounds per square foot compared with 1.33 pounds per square foot for the standard white strains. In these trials, 70—2 produced an average of 23 fewer mushrooms per pound.

During the autumn of 1960, a commercial white strain was compared with 70—2 in thirty-eight half-houses. The average yield in this trial for 70—2 was 2.18 pounds per square foot while the white mushroom produced 1.72 pounds per square foot. The average yield advantage for 70—2 from this comparison was .46 of a pound per square foot.

This cream mushroom has a cap which is scaly and coloured. The colour is concentrated in the scales and increases in intensity with increased scaliness. Although normally 70—2 is coloured a light yellowish-pink and is moderately scaled, under droughty conditions or relatively high air movement the caps are quite scaly and coloured a brownish-orange. At maturity, the cap frequently is strongly depressed in the centre. When compared with typical cultivated white mushrooms, the caps and stems of 70—2 are thicker and have greater density. The

mycelial growth in compost is finer and greyer. It is more prolific in pinning on the bed. The cooked mushroom is firmer in consistency and of stronger flavour.

Although 70—2 mushroom has been patented, transfers are available to interested parties upon request.

LITERATURE CITED

1. **R. Reeve, E. and W. A. Robbins.** Mushroom Strain Evaluation Studies, MGA *Bulletin* No. 73 : 10-13. 1956.

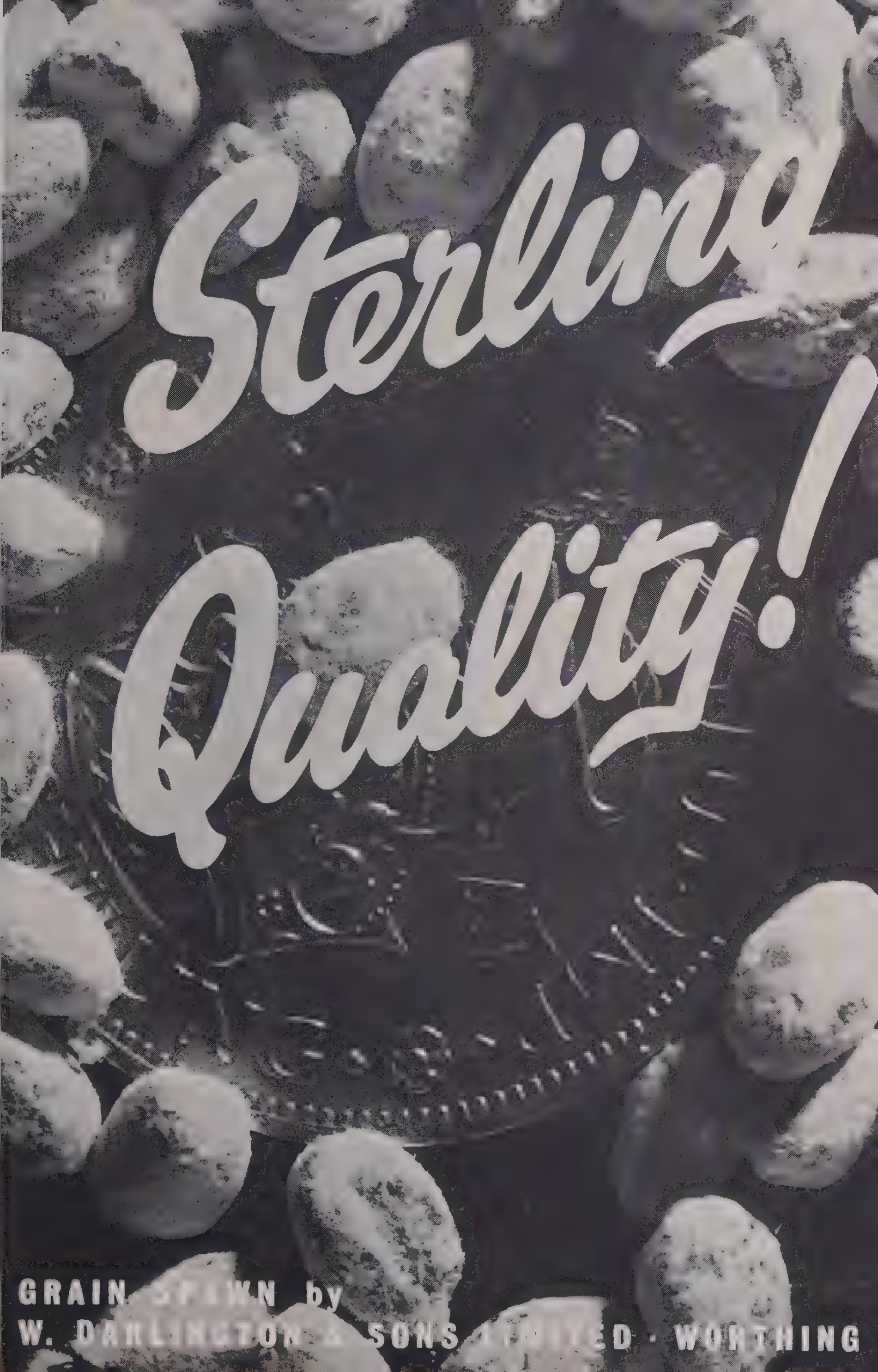
TABLE 1—MUSHROOM YIELD AND SIZE RESULTS WEST CHICAGO, ILLINOIS 1960

Source of Spawn	Yield* Lb./sq. ft.	Size No. mush./lb.
70—2	2.23	39
A—brown	1.69	15
B—white	1.52	39
C—white	1.52	47
D—cream	1.50	17
E—brown	1.20	20
F—white	1.20	38
Least difference required for 5%	.31	4
significance 1%	.41	5

*The yield weights are on the basis of good sound mushrooms with unbroken veils and trimmed stems.

This charming picture was taken by Mr. Bradfield of Broadlands Mushroom Farm, Martham, Norfolk.

The "mushrooms" are made of concrete. Location is Switzerland.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Weston-Super-Mare, October, 1960

PROBLEMS CONNECTED WITH A LARGE MUSHROOM FARM INCLUDING COST CONTROL

by **Graham C. Griffiths and W. Alan Dawson**

The problems peculiar to a large mushroom farm start as early in the programme as the collection of the manure; the purchase of a weekly requirement of upwards of 70 tons presents in itself an increasingly difficult problem, and it is inevitable that the collecting lorries cover great distances and spend many hours on the collection of part-loads from widely scattered sites. The manure, on its arrival at the farm, coming from so many sources, can never be as consistent in type and quality as supplies drawn from one or two stables, and as a consequence the most vital process in mushroom growing, composting, presents a very difficult problem to the large grower. Constant changes in type and quality of manure require close, skilled attention; different manures require various activators, necessitating expert knowledge in their use and a careful watch to avoid the accumulation of large stocks of unused additives; experimental facilities are often largely employed in the maintenance of a consistent compost rather than the development of new growing techniques.

Large peak-heat, spawn-running and growing houses are much more difficult to heat and ventilate evenly than smaller houses. Control of a disease and its confinement to a restricted area is also rendered more difficult in larger houses, and it is a hard task to instil into every member of a large staff the need for a high standard of hygiene.

Labour problems are greatly accentuated on the larger farm, which is equally likely to be situated in a small village, resulting in the employment of practically every worker in the vicinity, not all of whom can be expected to be first-class. On the small farm, all production processes can be satisfactorily supervised by the Owner and, say, a foreman, but on the large farm, with each process being a more complex operation and entailing the use of more and heavier items of machinery, more high-salaried technicians, foremen, mechanics, etc., must be engaged, usually from outside the local village, and this often necessitates the provision of housing accommodation, which in turn requires a competent building team, who may themselves require housing. In times of glut, it is much more difficult to find 15 or so extra mushroom cutters in a community of the same size as the small farm looking for possibly 2 additional hands.

The inevitability of the employment of more machinery can lead to a lack of personal attention to many small but vital details in the growing processes, and the dependability on more and larger machines requires a very close watch on their maintenance, as a breakdown of a machine on any process can result in the whole flow of production becoming held up and disorganised. If the principle of having available a spare machine for every type used is applied, the capital required is,

of course, extremely high. Again, the more widespread use of machinery requires more buildings to house the various departments thus created—workshops, garages, stores, etc., and almost inevitably, provision of housing accommodation for the additional technicians required.

From the sales aspect, it is more difficult to meet the differing requirements of a great number of customers, and constant attention to this problem is necessary to ensure that the right type of mushroom is despatched in the correct quantity to the various markets throughout the country, and to individual customers of widely differing requirements. It will be seen that the grading and despatch, which do not lend themselves to mechanisation, are extremely complicated and impossible to organise at long range.

Probably the biggest task confronting the large grower, however, is the control of costs—of course, this is a problem which confronts every grower, whatever his output, but on a large farm the avoidance of wasteful mis-use of labour, indiscriminate over-use of expensive materials, and prevention of other losses and wastages is much more difficult to achieve. Obviously a system of Cost Accounts is required, but are accurate costings possible on a mushroom farm, and if possible, do they really help?

Well, at Wrington Vale, we feel that Cost Accounts are as essential to the successful operation of the business as the more obvious routine tasks of the mushroom grower—*whatever the size of the farm.* The basic fact which has to be realised, we feel, is that mushroom growing really is a business, and not merely a form of light exercise—in exactly the same position, in fact, as a Company manufacturing generators or glass eyes. It is equally important that the mushroom grower, as well as his individual counterpart, must know not only that a profit or loss has been made in a given period, but how such a result has been obtained. He must analyse, therefore, his expenditure in such a way as to indicate what each unit has cost; what proportion of the cost has been expended in materials, wages and other expenses, and finally whether he has made a profit or loss on each unit. It is our view at Wrington Vale that a costing system is essential both in times of boom and depression—in good times leakages can be prevented, resulting in an increased margin of profit, and in bad times inefficiencies in production will be revealed and can thus be curtailed to minimise possible losses (or even convert possible losses into actual profits). It is perhaps superfluous to add that the mushroom industry rarely enjoys " normal " conditions anyway.

Accurate Cost Accounts, if properly interpreted and utilised will serve as:—

(*a*) a record of results for periodical statistics, and the preparation of periodical profit and loss accounts.

(*b*) a stimulus to economical processes, i.e., they keep the grower on his toes, and provide facts and figures on which he can base his thoughts.

(*c*) a means of detecting losses and wastages, of controlling expenses, and a safeguard against the accumulations of excessive stocks of raw materials.

(*d*) a means of holding down the total cost of production, in order to better withstand any downward trend in selling prices.

The system we use at Wrington Vale was evolved to give the information we think is most important, which is, broadly speaking, the cost per sq. ft., of laying down and maintaining the mushroom beds and the cost per lb., of cutting, packing and despatching the crop. The form in which this information is recorded is shown in Appendices A D, and the following notes regarding their use may be of assistance:

1. **Cost Analysis (Appx. "A").**

   In order to tie in more easily with other data (weekly production of mushrooms, weekly programme of spawning, casing, etc., and weekly wage payments) it was decided to keep the Cost Analysis on a 4-weekly basis, giving 13 equal periods in a year. A stocktaking of items 1 to 14 is therefore carried out on the last day of each 4-weekly period. Since items 27 to 32 are liable to very marked fluctuations, the sub-total following item 26 has proved very useful in obtaining an accurate assessment of basic production costs.

   The cost per sq. ft., of items 1 to 7 is considered to be of more importance than the cost per lb., which is therefore entered only as a total in col. (*b*), as is the cost per sq. ft., of items 8 to 11 in col. (*c*).

   Cumulative figures are calculated to enable a trend graph to be kept. It will also be seen that the grand total costs per lb., and per sq. ft., becomes more completely accurate as the year progresses, since any marked fluctuations in repairs, etc., are spread over a longer period.

   Since the growing area at Wrington Vale remains fairly constant, it was decided that the time lag between laying down the growing beds and the cutting and despatch of the resultant crops could be ignored, and the costs are therefore based on the area cased, and the lb. of mushrooms cut, during the period under review; these figures are entered on the chart under "Production".

2. **Wages Analysis (Appx. " B ").**

   The best method of carrying out each production process having been decided, and then carefully timed, it is possible to ascertain the rate per man hour which may be expected with a good average effort on the part of the workers employed on the various operations. Some of the operations are obviously better timed on " lb. per hour " basis (e.g., cutting, packing) whilst others are calculated on a " number per hour " basis (e.g., spawning and casing). These rates per man-hour are entered, where relevant, in col. (*d*) and can be checked against the anticipated target. The cumulative trend can be seen in col. (*h*).

3. **APPENDIX " D "** shows the reverse side of a specimen time-card, designed for the easy calculation of hours worked on the various processes—these are checked and initialled by the respective foremen.

APPENDIX "A"

COST ANALYSIS

Period No........................Ending.......................................196

ITEM	THIS PERIOD (a) Total Cost	(b) Cost Per lb.	(c) Cost Per Sq. Ft.	CUMULATIVE PERIODS (d) Total Cost	(e) Cost Per lb.	(f) Cost Per Sq. Ft.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1. Manure						
2. Manure Additivies						
3. Gypsum						
4. Insecticides						
5. Peat						
6. Spawn						
7. Stone Dust & Lime						
SUB-TOTAL						
8. Baskets						
9. Covers						
10. Rubber Bands						
11. Carriage Outwards						
12. Coal						
13. Fuel Oil						
14. Petrol & Oil						
15. Wages & Salaries (inc. NHI. *less* Capital Expenditure)						
16. Electricity						
17. Rent, Rates & Water						
18. Insurances						
19. Accountancy						
20. Telephone						
21. Sundries						
22. Depreciation						
23. Advertising & Stationery						
24. Postages						
25. Trade Expenses						
26. Travelling Expenses						
SUB-TOTAL						
27. Consumable Stores						
28. Vehicle Repairs & Expenses						
29. Plant Repairs						
30. Building Repairs						
31. General Repairs						
32. Boxmaking & Repairing (Mats.)						

APPENDIX "A"

PRODUCTION

4-Weekly Period	LBS. This Period	LBS. Cumulative	SQUARE FEET This Period	SQUARE FEET Cumulative
Period No. 1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

APPENDIX " B "

WAGES ANALYSIS

Period No............. Ending....................196

PROCESS	THIS PERIOD (a) Total Cost	(b) Cost Per lb.	(c) Cost Per Sq. Ft.	(d) Rate Per Man Hour	CUMULATIVE PERIODS (e) Total Cost	(f) Cost Per lb.	(g) Cost Per Sq. Ft.	(h) Cost Per Man Hour
1. Manure Haulage Inwards								
2. Composting								
3. Boxing-up								
4. Spawning								
5. Casing (Stacking)								
6. Clearing Out								
7. House Maintenance (After Casing)								
8. Watering								
9. Cleaning-up								
10. Cutting								
11. Packing								
12. Delivering								
13. Retail Round								
14. Boxmaking								
15. Repairing								
16. Miscellaneous								
17. Building Maintenance								
18. Office Admin.								
19. Outside Admin.								

REVERSE SIDE OF SPECIMEN TIME-CARD

	Thu.	Fri.	Sat.	Sun.	Mon.	Tue.	Wed.	Office Use Only		
BOXING-UP										Name ....
SPAWNING										
CASING (Stacking)										
CLEARING OUT										
CLEANING UP										
WATERING										
....										
....										
....										
TOTAL										

Question : Do you consider bonus schemes practical on a large farm?

Mr. Griffiths : I believe that when considering bonus schemes, as in costing, one must separate (*a*) the laying down of beds and (*b*) the picking of the mushrooms. We therefore have bonus schemes to cover each of these two headings. Firstly for those engaged on (*a*) we estimate a target, based on bed area, season, etc., to be achieved in an eight-week period and a bonus is paid on all mushrooms cut during the period in excess of that target. If crops are fairly good the bonus is in the range of £1 0s. 0d. –£1 5s. 0d. per week. An eight-week period is considered necessary to lessen the effect of large weekly fluctuations, and also keeps office work to a minimum. For those engaged on (*b*), a bonus is paid weekly on a lb. per hour basis.

We have found that the staff are much more interested and get the work done far more quickly than when we operated on a bonus which was paid annually and we, in turn, feel that we are getting very good value for the expenditure involved, in terms of increased interest and effort and lower labour turnover.

Mr. Rasmussen : The bonus period in Denmark is a fortnight.

Mr. Reed : What method have you for recording time spent on any operation? Is it kept by the foreman?

A.: Each employee keeps his or her time-card, which is checked by the foreman in charge of each separate gang and signed by him at the end of the week before rendering to the office.

Mr. Caley : If your picking is done ' piece work ' how do you keep the quality of your mushrooms?

A.: We have a man who does nothing else but look after the cutters: he doesn't cut mushrooms himself. He is responsible to the packing room foreman, who in turn is responsible to the firm.

Mr. Patterson : Once you are committed to a bonus scheme do you think you would be in a position to stop it if it didn't work out satisfactorily?

A.: We have had all sorts of bonus schemes. We used to work on a cash costs figure, estimating a cost per lb. for every lb. of mushrooms produced. I have forgotten what the figure was but we'll say it was one shilling, and anything saved on that shilling cost went to the staff. I don't know why, but that system failed. I think it was because we bought so much machinery, which obviously reduced our labour costs, so that we were paying for work done by the machinery. I think that introducing a bonus scheme was one of the most worthwhile things I have done.

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Weston-Super-Mare, October, 1960

AIR, WATER AND THE MUSHROOM

by **Dr. R. L. Edwards**, Ph.D., B.Sc., F.R.I.C.

The object of this paper is to collect and compare various workers' observations on the air requirement of mushrooms, particularly during cropping, to relate them to theoretical studies, and to follow up some of their consequences in theory and in practice as they affect humidity and the supply of moisture during cropping. The paper is not fully documented with detailed references to previous papers and I hope research workers whose contributions are not mentioned individually will excuse me.

One of the earliest studies of ventilation was by Lambert who found that high concentrations of carbon dioxide prevented normal cropping, 1—2% causing mushrooms to grow with long stems and small caps, while higher concentrations prevented fruiting completely. In practice even 1% of carbon dioxide in the air in a mushroom house must be rare, and is only likely to occur when a well constructed house has been tightly closed up for 24 hours or more. This is not quite as strong an argument against the belief that carbon dioxide causes damage in commercial houses as it may appear at first sight. I shall return to this point later.

An alternative hypothesis was raised by the work of Mader and others, suggesting that the mushroom produces a volatile metabolic product which, if not removed by adequate ventilation, causes growth of abnormal mushrooms, and in higher concentrations prevents fruiting. This work has been criticised for various reasons and recently Tschierpe has reproduced the abnormal forms of growth characteristic of under-ventilation by adding carbon dioxide to the air supplied to mushrooms growing in enclosed chambers.

The fact that carbon dioxide can cause these effects does not prove that some other substance is not produced and does not cause these abnormal forms in practice; it merely shows that it is no longer necessary to assume the existence of some other substance to explain the abnormal growth observed with under-ventilation. The view that carbon dioxide is responsible is also supported by the success of Rasmussen's experiments with caustic potash to remove carbon dioxide, though this could also remove other substances. About the next contribution on the practical side was Storey and Middlebrook's paper on the air to bed ratio, showing that in a range of commercial houses in use at the time (1950) the rate of production and final yield both fell if the ratio of air space to bed area fell below 4 cu. ft. of air per sq. ft. of bed area. At about the same time Burrows was analysing compost at various stages of the crop, and from the dry matter lost was able to calculate the rate of production of carbon dioxide. These observations showed that about one change of air per hour would be enough to remove the carbon

dioxide as fast as it was formed, and the rate of carbon dioxide production decreased as the beds grew older. Storey and Edwards reviewed ventilation requirements in the light of this and other work and concluded that 1—2 changes of air per hour were enough.

In all this work the atmosphere in the house was viewed as a whole, and it must be considered as applying to typical houses, mostly with " natural " ventilation, around 4 cu. ft. of air space per sq. ft. of bed, using shelves or trays.

A startling change in viewpoint was introduced by the experiments of Rasmussen, using closed chambers with only about four inches of air space between the bed surface and the top of the chamber, and with controlled air movement evenly across the bed. With this arrangement he found that yield increased strikingly as the number of air changes per hour was increased up to 16. Further increase up to 32 changes per hour produced little or no further benefit. It is essential to consider these results in terms of the experimental conditions; this is made quite clear in Rasmussen's paper but is sometimes overlooked. It should also be noted that the yield of 19.46 kg./sq. m. obtained with 16 changes of air, and the highest yield of all, 21.75 kg. with 28 changes, are not much higher than the 18.77 kg. produced by control beds, without specially regulated air circulation, in the main body of the house. The test chambers were situated inside this house, and the air for them was drawn from the main body of air in the house, and was returned to it. Therefore the control beds in the house were in air conditions not far from the best in the experimental range, and for the practical grower the extent to which yields may fall if the air supply is cut down may be quite as significant as the possibility of raising an already satisfactory yield by further increasing the air supply.

At Copenhagen Lambert quoted some results obtained by Reeve in U.S.A.; with 1 cu. ft. of air per sq. ft. of bed 5—6 changes of air per hour gave the best yield. It is interesting to note that both sets were equivalent to giving about 5 cu. ft. of air per sq. ft. of bed area per hour. This is also equivalent to a rate of one change of air per hour with an air to bed ratio of 5 cu. ft. per sq. ft. The agreement should make everyone happy! It may also help and encourage those thinking in terms of a predetermined air supply by input fan to base their plans on a *minimum* of 5 cu. ft. per sq. ft. of bed.

There is another factor, moisture, to be considered, to which I shall refer later.

There are several factors which may modify the application of these results in practice. Deep beds must produce more carbon dioxide than shallow ones of similar compost, and therefore need more air to remove it. Burrows observed very active respiration during the growth of a flush, and although I do not know any figures from which the total effect in a house could be estimated, air requirement must be higher as the mushrooms approach the picking stage than it is between flushes. Tschierpe's work also supports this view.

Houses normally producing moderate or low yields for reasons other than lack of air will have a correspondingly low air requirement. If the grower suddenly makes adjustments which substantially raise their general level of cropping, this may create a ventilation problem; the air supply may have been enough for the previous level of cropping, but not enough for full, normal growth at a higher level.

So far we have mostly been considering the mass of air in a house. But in a house, as in Rasmussen's chambers, the mushroom grows in a layer of air only a few inches thick over the bed surface, and it is the carbon dioxide (and other metabolic products) in this layer which affects the mushroom. Carbon dioxide produced inside the bed diffuses out from the surface of the bed into this layer of air (though some may escape from the bottom and sides of the bed), and carbon dioxide produced by growing mushrooms is discharged into this surface layer of air on the bed.

There are two ways of removing the carbon dioxide, by movement of the air as a whole, taking the carbon dioxide with it, fresh air moving in to take its place; and by diffusion of the carbon dioxide, without any need for movement of the air as a whole. In practice both must usually occur.

Diffusion is the gradual movement of molecules of a gas, through a stationary mass of air, from a region of high concentration, tending to equalise the concentration of gas in all parts of the air space. Thus if a quantity of carbon dioxide is released at one end of an enclosed space, it will form a high concentration there, and it will gradually diffuse through the air to all other parts of the space, until the concentration is equal everywhere. There are foımulae relating the concentration, rate of diffusion, etc., of gases, which need not be quoted here. If it is assumed that carbon dioxide is being produced in the bed at the rate observed by Burrows (100—200 ml. per sq. ft. per hour), and that it is dispersed only by diffusion upwards, the kind of concentration gradient established would be about 1% at bed surface, (much the same as that inside the bed, where Tschierpe found 0.3—3%) down to 0.1% at 8 inches above the surface, and a lower concentration still at twice that height. Thus the mushrooms would be forming in a layer with a relatively high concentration of carbon dioxide. That is why symptoms of inadequate ventilation, particularly long stalks and small caps, may occur on beds and may be caused by excess of carbon dioxide in the air, even though the general level of carbon dioxide in the house is well below the apparent danger level. Quite slow air movement across the bed removes the carbon dioxide as it is released from the bed.

In Rasmussen's experiments the speed of air movement at 16 changes per hour was about 54 ft. per hour (1 ft. per minute) which is almost imperceptible, but this would be enough to remove all the carbon dioxide, keeping the concentration below 0.1%.

In commercial practice there are complications. Air movement is never as uniform; it cannot, by any method I have seen or heard of


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so far, be directed as close to the surface of the bed as in these experiments, and the air rarely has to travel only a yard over the bed. The uneven flow means that some parts may have no air movement but most are likely to have a higher rate several inches above the bed.

Distance travelled has quite a big effect. Air moving at 4 ft. per hour across a bed 4 ft. wide gives one change of air per hour. Moving along a bed 40 ft. long, an air speed of 40 ft. per hour is needed to give one air change over the bed as a whole. Clearly it is better to blow air across the beds rather than along them.

This becomes important at high rates of air flow when there may be a drying effect on the mushrooms. Reeves found that at RH 90—95% air movement faster than 8 ft./sec. caused scaling of the mushrooms, at RH 80—85%, 2 ft./sec., and at RH 70% the maximum permissible was 0.5—1 ft./second. Spoelstra in Holland found that air speeds over 4 inches/sec. (20 ft./minute) caused scaliness (at unspecified RH, probably about 80%).

Such speeds, much higher than were needed, for example in Rasmussen's experiments, may be desirable in houses where distribution of the air is less perfect.

Also, half grown mushrooms on the beds are an obstacle to air movement and to diffusion, and high air speeds in the clear spaces may be needed to get any air at all through where there are closely packed mushrooms.

Thus for practical purposes there are two requirements, adequate renewal of air in the house as a whole, and movement of air over the bed surface.

When air is renewed by fans the quantity per hour is or can be known.

When it depends on " natural " ventilation this is not so easy, and among other things the effect of wind is not always appreciated. The air flow through a ventilator opening facing a wind is proportional to the air velocity. Thus a typical door with cracks equivalent to 12 square inches of opening, facing a wind of 4 m.p.h. admits approx. 1,500 cu. ft. of air per hour; if the wind is 16 m.p.h. the air flow is 6,000 cu. ft. per hour (enough for a 1,000 sq. ft. house) and so on. It is necessary that there should also be an equivalent outlet for the air displaced. In fact I have noticed during the winter with all vents closed that the Relative Humidity inside a house is always lower on windy than on still days, showing that more fresh air is getting into the house.

When the air inside the house is warmer than that outside, the " stack effect " causes a change of air if there are top and bottom ventilators and the rate of air flow is proportional to the difference in height between the ventilators and to the square root of the difference in air temperatures: e.g., temperature difference 16° F. gives twice as much air flow as temp. difference 4° F.

Moisture. The need to water is as old as mushroom growing itself, but it is much greater in houses than in caves where mushroom growing started and where the air is very humid. It was suggested long ago that some evaporation from the beds is essential for fruiting, and Bels Koning observed that in caves where the Relative Humidity was high and ventilation very slow, so that there was no evaporation, fruiting did not occur: it has also been suggested that this might not have been due to lack of evaporation.

Plunkett has shown for another higher fungus (Polyporus) that the rate of evaporation of moisture from the growing fruit body has a marked effect on size of fruit body. Within the range of his experiments, high evaporation in dry air gave much larger caps than those grown in moist air (96% RH) where evaporation was much slower. Similar but less decisive observations have been made by others on agarics.

At MRA some measurements showed that evaporation from the casing soil on mushroom beds was much faster in winter, when houses were heated, than in July, when they were not. The MRA houses had a fairly high rate of air change, and tended to be very dry in winter.

Mushroom beds with a moist peat casing are extremely efficient humidifiers, and as long as they are kept moist by watering they will maintain a high Relative Humidity (80—95%) in a house receiving a continuous supply of cold dry air.

What happens is worth examining. We are accustomed to think of the air conditions as being defined by the temperature, Relative Humidity, and perhaps rate of air change and rate of circulation. But the Relative Humidity is far from being a static quantity.

We might compare three houses, *House A* in winter with heat on, little ventilation (1 change/hour) with outside air at 40° F., RH 85%, which was typical of last February, *House B* in summer without heat, the same rate of air change, 1 per hour (though ventilators would have to be wider open to provide this), and outside air at 60° F., RH 83%. In practice it is more likely that in summer much more air would be given, and we should have *House C* with say five changes of air per hour, outside air again 60° F., RH 83%. It would be quite possible to maintain all these houses at 61° F. and RH 89% but the growing conditions would be quite different.

If all three houses had 1,000 sq. ft. of bed and 5,000 cu. ft. of air space, each change of air would take up from the beds in *House A* 2,920 grains of water per hour, or 12.5 pints in 24 hours; in *House B* 475 grains of water per hour, or 2 pints in 24 hours; and in *House C*, 5 changes per hour would take up 2,375 grains of water per hour or 10.2 pints in 24 hours.

These values may be compared with the rates of evaporation observed at Yaxley in April and July, 1944, 6 gallons and 2½ gallons per 1,000 sq. ft. per 24 hours respectively.

The comparison suggests that the Yaxley houses were having much more than one change of air per hour.

There is water in the mushrooms picked, and this must accumulate gradually as the flush grows. At 1 lb. of mushrooms per sq. ft., plus an allowance for stalks, stumps, and some attached casing, it is not likely to amount to more than 1 lb. (4/5 pint) per sq. ft. for each of the first two flushes, and less than this for the later ones; allowing 7—10 days per flush this is about $12\frac{1}{2}$ gallons per 1,000 sq. ft. per day. However there is considerable evidence to show that this comes from the compost, in which case it does not help to explain what happens to the water we put on the casing. Even so the quantities seem to me considerably smaller than are usually applied to beds in ordinary commercial watering.

Thus evaporation from a moist casing depends on:—

1. the condition of the air in the house (temperature and humidity)
2. the condition of the air coming into the house
3. the rate at which air is coming into the house
4. the loss of moisture from the air by condensation on cold surfaces; this has not been mentioned so far and is extremely difficult to deal with quantitatively.

The *rate* of evaporation depends on the degree of unsaturation of the air in contact with the bed, and on the rate of air movement over the bed.

Four typical sets of conditions may be considered.

1. Dry incoming air with little circulation does not dry the beds very quickly, air condition stays dry, low RH, moderate watering keeps beds moist.
2. Dry incoming air with rapid circulation is quickly humidified, RH *can* be kept up, but beds need much more watering.
3. Moist incoming air with little circulation, approaches saturation over beds, possibly harmful to crop, little watering needed.
4. Moist incoming air with rapid circulation, high RH in house but evaporation continues, more watering needed than in case 3.

Of these 1 is fairly harmless but unlikely to give the best yields: 3 is dangerous because very little extra watering can be too much: 2 and 4 are fairly safe, and more likely to give good results but depend very much on correct watering.

Practical application

The objects are:—

To keep carbon dioxide below a harmful level over the beds.

To remove water vapour coming from the beds, some of it driven off by heat produced in the beds.

To avoid over-drying the mushrooms and the beds.

To conserve heat in winter.

To maintain the casing at the "correct" moisture content.

Temperature and Humidity of air

Dry bulb °F.	Wet bulb °F.	Dew pt. °F.	RH%	Water grains per cu. ft.	Water pints in 5,000 cu. ft.
32	32	32	100	2.02	1.4
	30	27	80	1.6	1.1
35	35	35	100	2.4	1.71
	32	28	72	1.73	1.2
	30	21	54	1.30	0.9
40	40	40	100	2.8	2.0
	37	33	75	2.1	1.5
	35	28	60	1.68	1.2
45	45	45	100	3.4	2.4
	42	38	78	2.66	1.9
	40	34	64	2.18	1.6
	38	29	51	1.74	1.2
50	50	50	100	4.1	2.9
	48	46	87	3.57	2.5
	45	39	67	2.75	2.0
	42	32	49	2.01	1.4
55	55	55	100	4.8	3.4
	52	49	82	3.94	2.8
	50	45	70	3.36	2.4
	48	41	59	2.83	2.0
60	60	60	100	5.7	4.1
	58	56	89	5.07	3.6
	55	51	73	4.16	3.0
	52	45	58	3.31	2.4
	50	40	48	2.73	1.0
65	65	65	100	6.8	4.9
	62	60	85	5.8	4.2
	60	57	75	5.1	3.6
	55	47	52	3.54	2.5
70	70	70	100	8.0	5.6
	68	67	90	7.2	5.1
	65	62	77	6.2	4.4
	60	54	55	4.4	3.1

We do not yet know just how much, if any, evaporation is necessary to the mushroom for satisfactory fruiting.

Taking into account what has been said, and general experience, it seems to me that greater differences between winter and late summer management, to quote the two extremes, are desirable.

I suggest as a winter regime when house heating is in operation:

Minimum ventilation which is enough to keep down the general level of carbon dioxide, some artificial humidification, moderate air circulation over the beds (between Rasmussen's top rate and the speed at which scaling occurs), with fairly generous daily or almost daily watering.

And in late summer, maximum ventilation except in extremes of temperature, maximum circulation over beds; unless outside dew point rises above inside air temperature for long periods at a time (several days), still give frequent but lighter waterings.

Between these extremes, treatment must be adjusted according to variations in outside temperature, humidity, and wind strength, to obtain acceptable conditions in the house.

The Chairman asked Dr. Edwards to re-word and answer a rather long question.

Dr. Edwards : I think the answer will indicate the question, which is about measurement of carbon dioxide in air in a shallow layer being blown over cropping beds on an experimental scale. I don't know of any work in which the CO_2 has been measured with the incoming air, being a natural air source and not artificially enriched. The only work I know of is Tschierpe's, where the CO_2 was being put into the air. It has been done in a closed chamber where the CO_2 was allowed to accumulate ; that has been measured but not on a moving air system, as far as I know.

Mr. Figgis : Is 5 cu. ft. of air per square foot sufficient for mushrooms?

A.: I thought I said it was a minimum required to remove the CO_2. Lambert when discussing Reeve's results with an air/bed ratio of 1:1 and five changes and comparing that with Rasmussen's results, worked both out at about 5 cu. ft. per sq. ft. I would certainly give more, as long as it can be done without excessive drying; as you increase ventilation you increase drying and that, I think, is undesirable on that sort of scale. So if you have artificial humidification, or under conditions of damp enough air outside, that is to say humid air, I would certainly give more than 5 cu. ft.

Mr Figgis : There are crowded conditions in mushroom houses. Can anything be done in heating and humidifying fresh air?

A.: Yes, I think that is one of the things which will come quite soon. We probably know enough about what is required to go part of the way now. I think in the next year or two, with the work which is being done, we shall know more and be able to do much more. With crowded houses you must have provision, and more positive provision, for ventilation and for circulation. With very crowded houses you actually need less humidification than in an uncrowded house because your bed will do it for you. And, on humidification, I think

it is desirable to apply it to the incoming air, particularly in winter when the air is coming in cold. If you have a crowded house you bring in more air to satisfy it and probably overdo it for the sake of safety, making sure that you are over the minimum. Then it is much better to humidify as the air comes in rather than to humidify once the air is inside the house, in which case you are only sharing the burden of providing moisture with the bed. If you humidify the air by any device just standing in the house, the beds are still probably doing a big proportion of it. If you can put your humidifier in the air intake you are taking as much as you want of the load off the beds entirely. We don't yet know how much humidity we want, but that is the right way to approach the problem.

Weston-Super-Mare, October, 1960

25 YEARS OF MUSHROOM GROWING

by R. Duthy

It would be easy to address you, ladies and gentlemen, if my life had been as simple as Lord Montgomery's. He is alleged to have addressed a gathering of Frenchmen with the, perhaps apocryphal, remark, " Mon derrière est divisé en deux parties " –" my past, or behind, is divided into two parts! "

My own life has been as long but more varied, and after being soldier, mining engineer, business man I finally became a mushroom grower and farmer but cannot claim to have made a great success of any of them. With this disarming modesty it may be not too daring to make one or two frank remarks.

When I took my coat off in the Lea Valley to learn this fascinating business, mushrooms were primarily a catch crop and, provided the basic rules of composting were followed, success was fairly assured. It was with the general advance of purpose-built houses that the trouble ensued and I will have a suggestion to make in this connection later.

I had a friend called Davison who, after the first war, evolved a synthetic so that it wasn't necessary to ask the horse to oblige. I used it for about ten years with fair, but not outstanding, success. The basis was fish manure and provided the Nitrogen and Phosphorus were balanced the phosphate content was not considered of overriding importance. It has of course been superseded more successfully as a result of the painstaking efforts of Dr. Edwards and his colleagues.

When the second war started I had just completed and filled five houses but of course everybody skedaddled out of London and there were frequently ' No Sale ' returns. I had other things to do but with the encouragement of my wife we got going in time for the first serious bombing of London and once again had the melancholy ' No Sale ' results. We tried a third time and were lucky. It is fascinating to reflect that with labour and material we could have made about £2,000 0s. 0d. per annum profit as the wholesale price was sometimes 10s. 0d. per lb.

If you were a gathering of people considering the cultivation of mushrooms I would be induced to give you the age-old advice of Punch to the young couple contemplating marriage. It was " Don't "; but most of you are now married to mushrooms and have contracted a dangerous and indissoluble liaison. You have no doubt found that, as with women, you can neither live with them nor without them, so let us accept the inevitable.

After the war I decided to go to the U.S.A., where I was so much helped by my good friend Jim Sinden. The tray system was of course in use many years ago in the Lea Valley where we used to use Polish and Chinese egg boxes which were thrown away after use. The Sinden system was, of course, a much more refined affair and I think I was one of the first to adopt it. I believe 45% use it now. There are still centres of rebellion in Yorkshire and elsewhere.

When I suggested that the perennial financial crisis in the MGA and MRA could be solved by the manufacture of spawn I was laughed to scorn, but there are people to-day who are entering this field. It is quaint to think that even the efforts of a gallant Corps Commander were insufficient to calm the contumely inspired by my well-intentioned suggestion !

Now I come to a point which may cause comment. A mushroom grower must sooner or later decide whether to plump for the robust commonsense of a " pinhead ", or follow the sometimes inspired ideas of an " egghead ". Recently a European scientist put forward a novel scheme of spawning which on paper seemed to be the answer to the maiden's prayer. I adapted a D.L.P. composter at a cost of £120 0s. 0d. and continued to pray, hopefully. Now, ladies and gentlemen, I do not dispute that, given exactly the right conditions, it will work. All I can tell you is that I lost the crops from five houses and was bedevilled with plaster mould for the first time. Reluctantly I had to turn wistfully back to the " pinhead " ! Gimmicks are off.

At this time I do not get more than 1.2 lb. per sq. ft., on horse manure, $5\frac{1}{2}$ times yearly. I get wonderful crops of flies, *Mycogone*, *Dactylium*, etcetera, and this brings me to a point which may be of interest to growers. All farmers know that land becomes sheep sick or potato sick and this phenomenon occurs in all forms of life. In mushroom growing I feel that however efficient sanitary precautions may be—and we can't all be Nobles or Sindens—infection is likely to recurr.

Now, it is a fact that growing conditions for mushrooms are very similar to those required for broilers because I do both and very little additional capital is required. During the summer months it should be easy and profitable to break the continuity of mushroom growing

by interposing a crop of broilers and if anybody is interested I would be glad to discuss this. Many diseases, flies and viruses peculiar to mushrooms do not affect chickens and *vice versa*. Also, in the summer mushroom prices fall but broiler prices do not.

If this suggestion is of value I would be delighted because I have met with such immeasurable kindness from mushroom growers and it may repay a small part of my debt.

Mr. Gook : What is your method of cooking out?

Mr. Duthy : With steam and fans.

Mr. Figgis : In spite of your claim to cook out at a temperature of 140 deg. F., you still find disease carried over. Could this not be because the surfaces of the walls may only have been 120 deg. F?

A.: In point of fact, I put a remote-reading thermometer at the bottom of the lowest tray in the middle of the house against the wall and I always get a reading of between 135 deg. F. and 140 deg. F.

Mr. Figgis : Unless one has a howling gale re-circulating the air within the house there is a serious drop in temperature between the actual surface of the wall and the air immediately surrounding the thermometer.

A.: In the cooking out of the houses with Calor gas I have two large fans which blow air down from the roof where the air temperature may be as high as 240 deg. F. The fans have been specially wired and directed to bring that air down and circulate it round the walls. I am satisfied that the air temperature is 140 deg. F. and nearly all the compost is 135 deg. F. but one must have specially wired fans and I do not use an awful lot of Calor gas.

Dr. Chapman : Do you think that wild mushrooms in your surrounding neighbourhood could be a source of infection in your case?

A.: I think it is quite probable, but that's a job for an egghead. Obviously it's out of our control. I should like to make clear that there is a period of four weeks during which there is no mycelium on the farm.

PUBLICITY

Mushrooms have one ' built in ' advantage as far as publicity is concerned and that is that they are an unbranded product. This means that we can talk to journalists, broadcasters, firms and organisations and persuade and encourage them to use and to publicise mushrooms, and this is the basis of our publicity activities at the moment. We cannot spend a great deal on advertising through nation-wide poster campaigns but we can achieve a great deal through regular contacts with the press

and any other body which handles food and does publicity. The regular services we provide are handouts with articles and recipes, photographs, recipe leaflets and fresh mushrooms for cookery and photography. This gives a very real point of contact and a circular reminding people of these services brings a rewarding response. One issued in January brought contacts and offers of co-operation from Prestcold, Campbells Soups, Nestles, Bibbys, and the Butter Information Council ; requests for mushrooms from Womans Own and Philip Harben (who was so pleased with those he received that he is planning to do a special mushroom article in April) and requests for recipes and photographs from smaller magazines and provincial newspapers : Modern Knitting, Supermarkets Journal, and Doreen Davies of the " Birmingham Mail ".

We have continued to support demonstrations given by regional Gas Boards by providing leaflets and mushrooms and are co-operating in further demonstrations in Colchester, Cambridge and Croydon this Spring. We have also supported the Potato Marketing Board demonstrations which, in the Autumn of 1960, covered the following towns: Whitby, Alnwick, Macclesfield, Sunderland; and in 1961 the programme is as follows: Lancaster, Mexborough, Accrington, Driffield, Manchester, Nantwich and Shrewsbury. Each demonstration is supported by display advertising in the local press timed to coincide with the demonstrations.

Our supply of paper bags is now running low; ten million have been sold and a new issue, possibly with a new look, is being planned for the near future.

These are the basic activities which we will always maintain, but our other activities will vary from year to year according to what is considered to be the most fruitful line of approach and also according to what we can afford to do. The Publicity Committee has decided that it is best to limit our activities to a certain extent and concentrate our maximum effort in one particular sphere.

This year we planned to have a special town promotion to find out how far it is possible to boost the consumption of mushrooms and having done that how far it is possible to maintain the increased rate of consumption. This programme will be supported by a campaign based on a new range of co-ordinated material. This should be a major step forward in the development of our publicity activities. All future programmes can be co-ordinated by using this advertising material and we can now hope to make a national impact even if only on a long term basis, because all our activities will be based on the general fund of publicity material. This is the first step towards having a general national campaign bringing mushrooms to the attention of the whole country in one high powered nation-wide flourish of advertising. We hope that this day will come but until it does our publicity will continue to be planned with the aim of making the biggest impact with what we have.

Miss Owen with Benny Hill.

On 28th February, we held a rather unusual ceremony. We invited the well-known comedian and singer Benny Hill to Agriculture House and presented him with the 'largest basket of mushrooms in the world'. (We did no research before making this claim but as the basket held over one and a half hundred weights of mushrooms we feel that it is quite justified). This all sprang from a 'phone call from a member of the Association who had heard the first broadcast of Benny Hill's record 'Gather In the Mushrooms' and who suggested that Benny Hill's originality should be rewarded with a present of mushrooms.

We had not at first intended to make this a terribly impressive affair; we were just going to deliver a chip of mushrooms to Benny's flat and say "thank you". However, when your PRO attempted to do this she found herself chasing around London desperately trying to find Benny Hill who had just moved from the address given in the entertainers' "Who's Who," and could not be found. We used the time for further thought and expanded the idea of the presentation to the impressive scale of the world's biggest basket of mushrooms.

Benny Hill seemed quite pleased with the idea and accepted the mushrooms to give to St. George's Hospital which he visits regularly: he came to Agriculture House, received the mushrooms and then, with the help of the Chairman, he dragged the mushrooms on a trolley to the hospital and presented them to one of the staff. After this feat of strength he was hastened back to Agriculture by members of the MGA and suitably fortified.

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EXECUTIVE COMMITTEE

Area C Election Result

There was a 56% poll in Area C in connection with the election for one Area Seat on the MGA Executive Committee.

Mr. N. R. Cooper of Kimcote, Rugby, a former member of the Executive, was elected. Mr. P. K. L. Danks of Nottingham was the unsuccessful candidate.

Mr. Roy Simons of Harlow, head of the firm of J. E. R. Simons Ltd., of Harlow, Essex, has been elected, unopposed, for Area B (Essex, Herts., Suffolk, Cambridge and Norfolk) and Mr. Graham Griffiths, Vice-Chairman of the MGA Executive, has been returned, also unopposed, for the South Western Area (Area F). Mr. Griffiths lives at Congresbury, Somerset.

SMALL ADVERTISEMENTS *Continued on Page 136*

FOR SALE as going concern. Small Mushroom Farm, 6,000 Sq. Ft. Three Zone System. Purpose-built. Ample space for expansion. Attractive house, main electricity, water. New Aga cooker. Box No. 1.

MUSHROOM GROWER, experienced both in administrative and Technical side, seeks post on a mushroom farm, U.K. or overseas. Box No. 2.

 Contd. from p. 132

PURE DRIED GROUND POULTRY MANURE. This pure, natural organic is regularly used by prominent mushroom growing firms. It represents an invaluable *organic* activator for stable manure. Finely and evenly ground, it is convenient and clean to handle and being packed in ½ cwt. sacks, the weight you receive is *guaranteed.* Sample and prices (which vary according to the distance for carriage from our Works) on application. Sole Producers:—THE HAMPSHIRE GUANO CO. LTD., SOBERTON, SOUTHAMPTON. (Est. 1937.) Manufacturers of "Gunos" (Regd.) Brand Fertilisers.

CHALK AND CARBONATE OF LIME. Best quality Ground Chalk and Derbyshire Limestone supplied in bags; also broken chalk and limestone. DERBYSHIRE STONE LIMITED, Matlock. Telephone: 741.

REGULAR SUPPLIES of graded mushrooms required. Please write for Managing director to call. WRAY & PEASE LTD., Castlefolds Market, Sheffield 1.

MUSHROOM TRAYS. We have regular supplies of Danish and Norwegian fish trays for all your requirements. Please contact J. G. RODGERS, 4 Salisbury Row, London, S.E. 17. Telephone: Rodney 3640.

STERILISED SUB-SOIL for Casing Mushroom Beds; delivered in 10-15 ton tip up loads to any part of the Country. Particulars: F. A. SMITH, Homeleaze, Staunton Lane, Whitchurch, Bristol. Tel.: Whit. 2465.

JACKSON & LAKIN LTD., (Est. 1875) Wholesale Market, Nottingham, wish to contact Mushroom Growers, capable of loading daily.

CONCRETE MIXERS for sale or hire, Coopers, Builders' Merchants, Canterbury and Ashford.


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